EPA Environmental Technology Partnerships

Environmental Cleanup

U.S. Environmental Protection Agency

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Cooperative Research and Development Agreement With the Electric Power Research Institute

Bioremediation of Mercury-Contaminated Sites

Participants

This Cooperative Research and Development Agreement (CRADA) brings together researchers from the U.S. Environmental Protection Agency's (EPA) Environmental Research Laboratory, Gulf Breeze, FL (ERL-GB), Oak Ridge National Laboratory (ORNL), and the Electric Power Research Institute (EPRI).

Purpose

The purpose of this CRADA is to test a bioremediation technique to decrease levels of methylmercury (CH_3Hg^+) in mercury-contaminated freshwater sources and in indigenous fish stocks.

Background

Research will be conducted to evaluate the feasibility of bioremedial treatments for the clean-up of East Fork Poplar Creek in Oak Ridge, TN, a mercury-contaminated freshwater stream which receives wastewater runoff from a nearby nuclear plant.

The proposed approach for treatment is based on the stimulation of microbial transformations of $CH_3Hg(I)$ to volatile elemental mercury (Hg^0). The feasibility of this approach will be tested in microcosms and by using mathematical models developed by EPRI.

Both ERL-GB, ORNL and EPRI have extensive experience in treating mercury-contaminated sites.

Procedures

Remedial treatments will be tested in microcosms containing intact samples from the field. Through stimulation of indigenous microbes by the addition of growth-limiting substrates and the application of active exogenous microbes, it is anticipated that levels of $CH_3Hg(I)$ and Hg(II), the substrate for methylmercury production, can be reduced.

The study is scheduled to consist of three phases:

- Phase 1–Microcosm calibration
- Phase 2–Testing of remedial treatments
- Phase 3 –Testing of remedial treatments *in situ*

Phase 1 involves demonstrating that reactions of the mercury geochemical cycle in the microcosms simulate processes as they occur in the field.

Phase 2 will involve treating calibrated microcosms to enhance reduction and volatilization of Hg(II), including stimulation of microbial activities by adding limiting nutrients, introduction of naturally occurring, non-engineered mercury-reducing microorganisms, and chemical treatments with reducing substances.

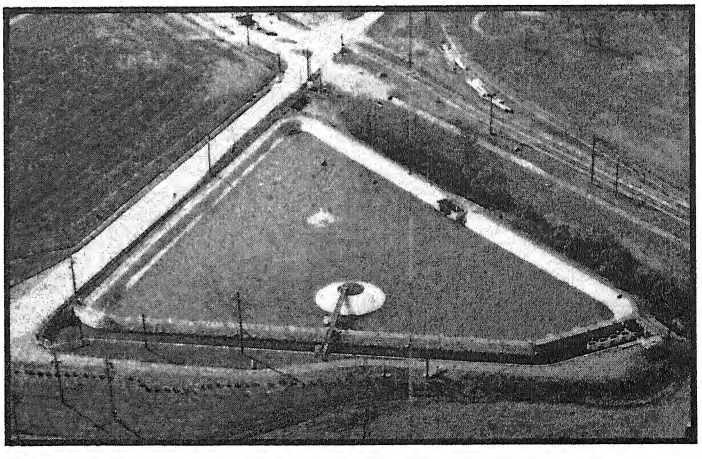
Phase 3 will involve applying treatments in the field and evaluating results.

Benefits to Government and Industry

Assessment of the ability to manage the aqueous speciation of mercury, and thereby the bioaccumulation of $CH_3Hg(I)$, is the major anticipated benefit of the research.

The development of microcosms that simulate the cycling of mercury will also be useful in studying other environmental problems involving mercury. These techniques may then prove effective in describing and rehabilitating a variety of mercury-impacted ecosystems such as the Florida Everglades, Onondaga Lake, and temperate lakes in the north and central United States and Scandanavia.

This is one of more than 50 cooperative research and development agreements EPA has with various U.S. busi-



Mercury settling pond.

nesses, academic institutions and state and local governments under the Federal Technology Transfer Act of 1986. These agreements serve as a mechanism for the federal government to work with the private sector and others to develop new pollution prevention control technologies and efficiently bring them into the marketplace.

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